iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 Issue: I Month of publication: January 2018

DOI: http://doi.org/10.22214/ijraset.2018.1052

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 6 Issue I, January 2018- Available at www.ijraset.com

Position Verification and Identification of Primary User Emulation (PUE) Attack in Cognitive Radio Network

Miss. Priti Patil[1], Prof. Mr. K.P.Paradeshi[2].
[1]P.G. Student, Department of Electronics Engineering, P.V.P.I.T Budhgaon, Sangli, India
[2]Associate Professor, Department of Electronics Engineering, P.V.P.I.T Budhgaon, Sangli , India

Abstract: Most of the people depend on the wireless spectrum in order to properly function. Wireless communication has many applications such as health services, national defense, security surveillance, financial transactions, and entertainment activities. These applications use the wireless spectrum. The use of wireless spectrum increases day by day, which results the wireless spectrum becomes overcrowded. Hence, most of the users cannot use the wireless spectrum efficiently. Cognitive radio is one of the fastest growing technologies in wireless communication. Cognitive radio is the solution to solve spectrum scarcity problem. In this network, unlicensed users share the spectrum of licensed user using spectrum sensing process. Spectrum sensing is important in transmission. When spectrum sensing process is disturbed, then the entire sensing process is disturbed, which is called as a primary user emulation attack. This attack is solved by using a localization method that is time-difference-of-arrival (TDOA).TDOA (Time Difference of Arrival) is simplest method for positioning. It is a kind of non-interactive positioning and uses the difference of arrival time, which is fit for the location verification of fixed transmitters.
Keywords: Cognitive radio network, primary user emulation attack, time difference of arrival, primary user, secondary user

I. INTRODUCTION

The use of wireless technology has increased day by day. Wi-Fi, WI-MAX, GSM, etc is popularly used by every person. Each of these wireless networks is carrying multiple communications. In the last 15 years, the percentages of people using the internet have increased most. Hence, radio spectrum becomes overcrowded.

The radio frequency spectrum is a sparse natural resource and its efficient use is the most importance. Satellite, mobile and fixed broadcast uses licensed spectrum bands to avoid harmful interference between different networks to affect the user. Most of the spectrum band has remained idle. Therefore, utilization of a spectrum band must be improved to meet the requirement of the spectrum. Spectrum is allocated only licensed users (primary users) are allowed use the spectrum band. A band of the spectrum is permanently allocated to users. These users are known as a licensed user. Most of the time licensed user does not use spectrum for communication. At that time spectrum remains idle. Therefore, frequency bands are simply wasted. According to new policy of FCC is to open up the licensed band to unlicensed users (secondary users) while no interference with licensed users [3].

Hence cognitive radio (CR), which enables opportunistic access to the spectrum, has emerged as the key technology. A CR is an intelligent wireless communication system, aware of its surrounding environment, and it adapts its internal parameters to achieve reliable and efficient communications [12]. These new networks have many applications, such as the cognitive use of the TV white space spectrum or making secure calls in emergency situations.

In cognitive radio network, there are two types of user primary user (PU), those who are licensed user and secondary user (SU), those who are unlicensed user. Primary user has the first priority to access the spectrum. When primary user is not active then secondary user uses that spectrum, as soon as primary user is becoming active, the Secondary user has to leave the channel for use by the PU. Since the Cognitive Radio (CR) provides the opportunity of spectrum usage only in the absence of the PU.

Secondary user continuously senses the spectrum; if a channel is found vacant the secondary user will be able to use the channel. The Secondary user performs sensing in order to detect the presence of Primary user. Secondary user senses the unused spectrum that is a spectrum hole in opportunistic ways. Spectrum hole is band of frequencies assigned to primary user, but, at particular time and geographic location, the band is not being utilized by that user [12].

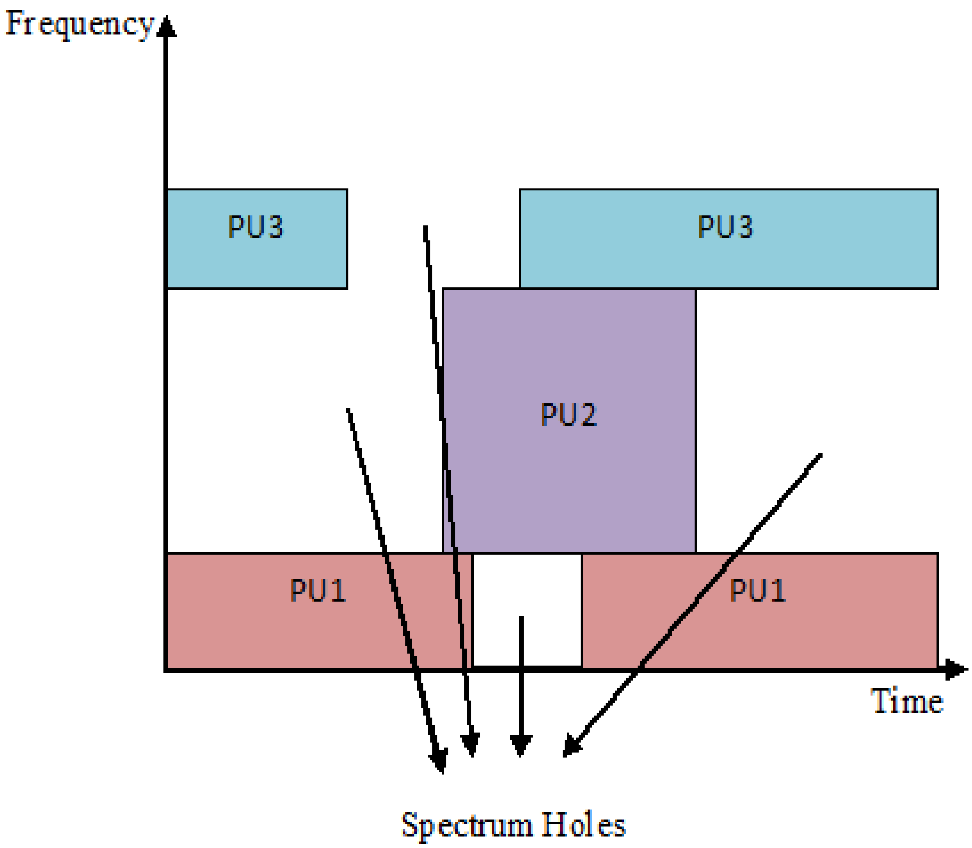


Figure.1. Representation of spectrum holes

A. Characteristics of cognitive radio are described as follows

1) Cognitive capability and reconfigurability

a) Cognitive Capability: It makes these devices to sense the information from its radio environment. Through this capability, the portions of the spectrum that are unused at a specific time or location can be identified. Consequently, the best spectrum and appropriate operating parameters can be selected.

b) Reconfigurability: It enables the radio to be dynamically programmed according to the radio environment. More specifically, the cognitive radio can be programmed to transmit and receive on different frequencies and to use different transmission access technologies.

B. Cognitive radio mechanism is described as follows:

1) Cognitive Cycle Mechanism:

a) Spectrum sensing is one of the important mechanisms in cognitive radio. All SUs senses the spectrum bands, and captures the information, and then detects the spectrum holes.

b) Spectrum analysis is process that based on available information of spectrum holes that is feedback from spectrum sensing. It analyzes various channel and network characteristics for each spectrum hole and later provides this analysis to spectrum decision process.

c) Spectrum decision is process which selects most appropriate spectrum hole for transmission. From previous spectrum information cognitive radio decides when to starts its operation. Cognitive radio main objective is to transfer as much as possible information to satisfy required QoS, without causing any interference to primary user.

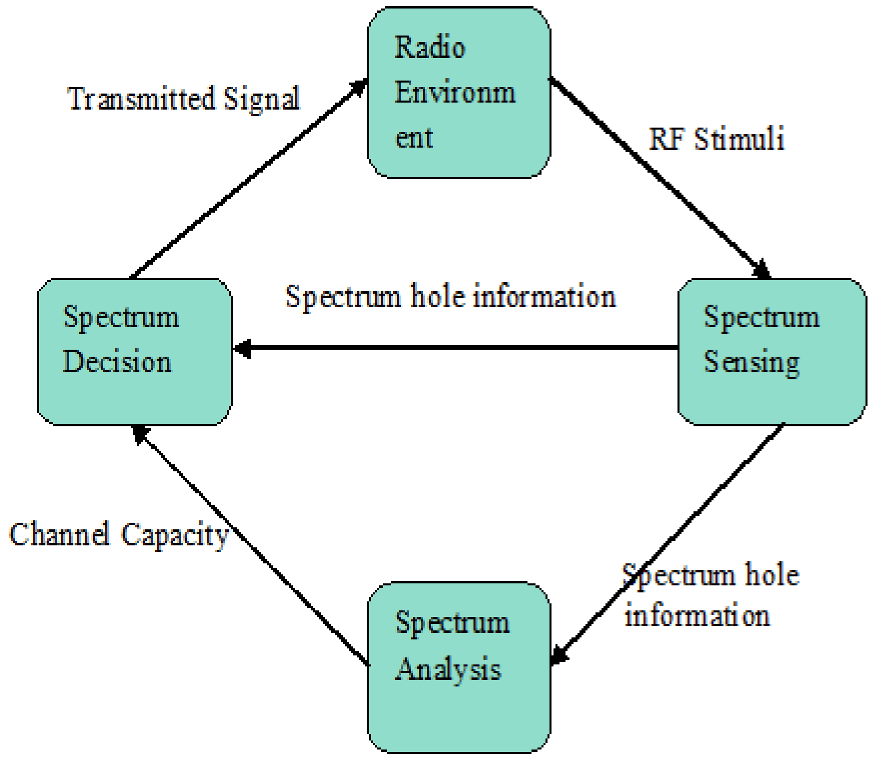


Fig 2: The cognitive cycle.

II. LITERATURE REVIEW

This paper describes concept of cognitive radio and detection of spectrum holes. Spectrum hole is band of frequencies assigned to primary user, but, at particular time the band is not being utilized by that user. This paper also describes different types of spectrum hole [12].

This paper describes the details of primary user emulation attack (PUE). Primary user emulation (PUE) attack can be classified in two ways first is selfish attack and second is malicious attack. And this paper also presents a new transmitter verification procedure for spectrum sensing. Transmitter verification procedure is the estimation or verification of location of a signal's origin. Cognitive radio continuously sense spectrum to check available channel [11].

This paper proposes a different approach to secure positioning that depends on the set of covert base station (CBS). Covert base station used for secure positioning. By the covert base station, base stations are those whose positions are not known to the attacker at the time of execution of secure positioning. For this some protocols are present in this paper [10].

This paper proposes a transmitter verification scheme, called localization based defense (Loc-Def). This scheme utilizes both signal characteristics and position of the signal transmitter to verify primary signal transmitter. Non-interactive localization scheme is introduced to detect PUE attacks [9].

III. PRIMARY USER EMULATION (PUE) ATTACK

The secondary user (SU) must have the ability of recognizing the primary user(PU) from SU signals. Some of the secondary users behave in bad ways and pretend itself as primary user to access the spectrum. Hence spectrum sensing process is corrupted is called as primary user emulation attack (PUEA).

Let assume a cell consisting one PU and 3 SUs. Secondary user starts utilizing a bandwidth it enters into cycle of sensing and transmitting signal till the time the secondary user needs the bandwidth. SU continuously senses the spectrum if spectrum hole is detected then transmission is done. This series consist of sensing and transmission cycles one after the other continues with time.

Fig. 3 shows the sensing and transmission slot of secondary user. Each secondary user first senses the spectrum band and then depending upon sensing results transmit during transmission slot and then again senses the spectrum band.

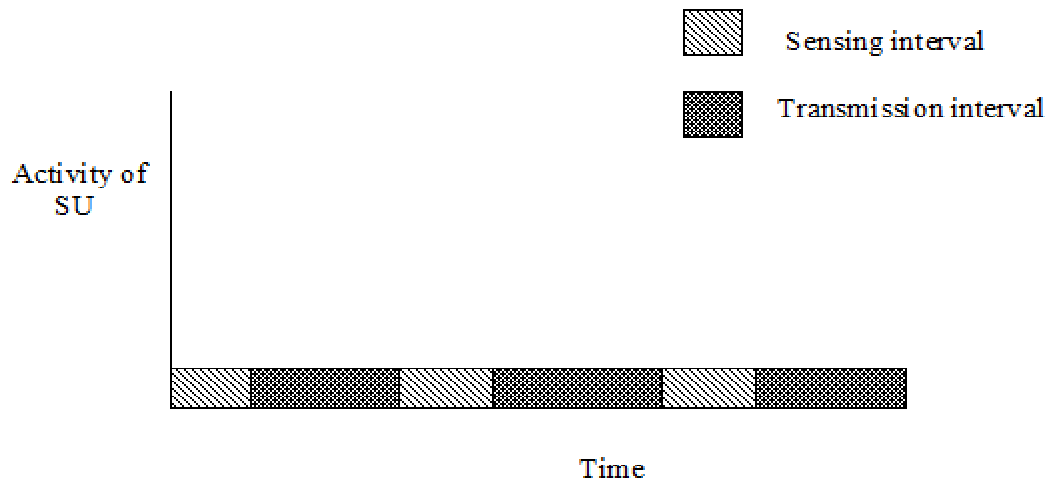


Fig. 3 Representation of usual activity of secondary user sensing and transmission slot.

Fig. 3 shows the simple scenario of secondary user sensing and transmission interval. Fig. 4 consists of one primary user and three secondary users. Initially primary user is in inactive state. When primary user is inactive, SU_1 arrives and perform sensing to check for availability of bandwidth. After sensing SU_1 finds the network to be available and transmits. Once SU_1 is transmitting SU_2 arrives and senses the availability of networks and finds network to be unavailable hence enters into wait state. In meanwhile SU_1 finishes its transmission and leaves the network deliberately. Again SU_2 senses the network and finds the network available and then enter into transmission state. When SU_2 finishes its transmission it leaves the network. Then SU_3 comes and checks the availability of network if network is available then it goes into transmission state. After completion of first transmission SU_3 has some more data to send for transmission hence it again senses the network to check the reappearance of PU and SU_3
finds PU to be active therefore SU_3 has to leave the network. Because PU has the high priority.

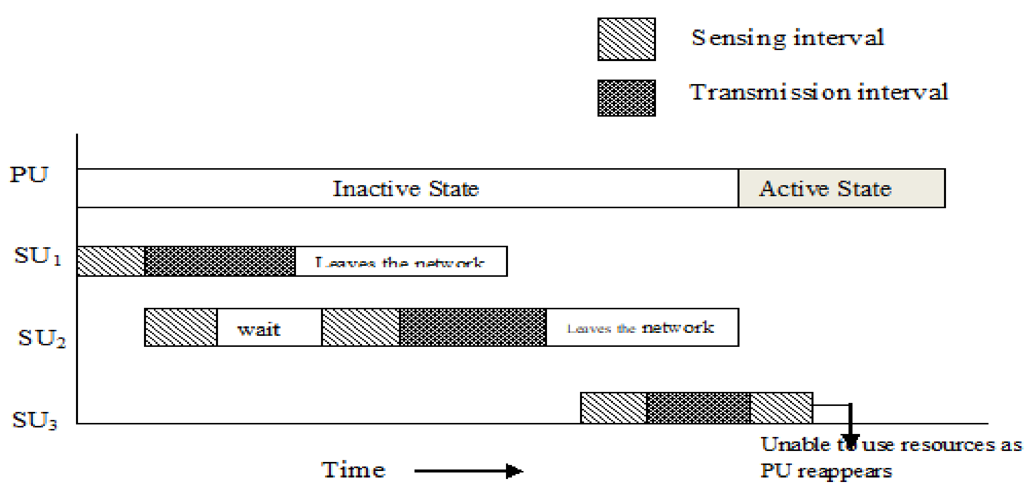


Fig 4 Representation of ideal case consisting of a PU and three SUs

Now let assume an attack scenario where malicious SU named as SU_m emulates all characteristic of PU and behave as PU. SU_m makes network unavailable for others SUs. Fig. 5 shows that SU_1 comes and senses the network to check the availability of bandwidth. Based on sensing result it transmits and leaves the network. While SU_1 was transmitting, SU_2 come and performed sensing and entered into wait state. As soon as SU_1 leaves the network, SU_memulates the characteristics of PU and pretends itself as PU. SU_2 senses again the network but malicious SU is pretending to be PU thus making SU_2 to enter in other wait state. Ultimately SU_2 leaves the network without transmission. This phenomenon is called as Primary User Emulation Attack.
Similarly SU_3 senses the network to check availability of spectrum but finds it to be unavailable because of emulation attack.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 6 Issue I, January 2018- Available at www.ijraset.com

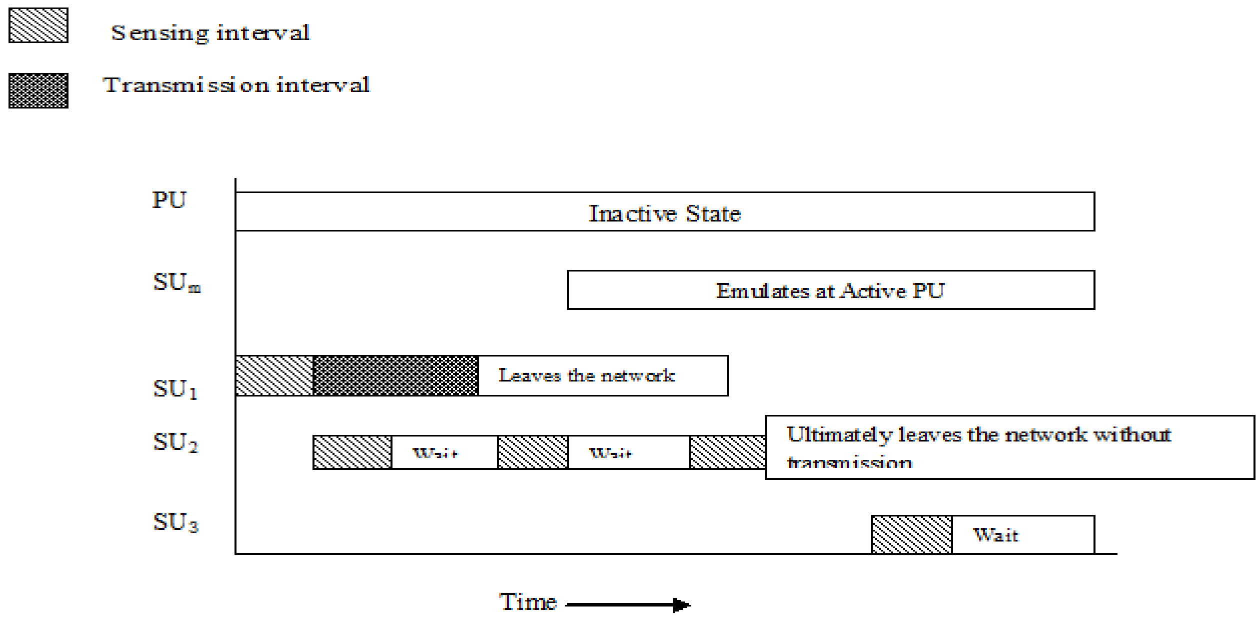


Fig 5 Representation of attack scenario by malicious SU making network resources unavailable.

If the PUE attack is successful then cognitive radio technology is unable to provide access to unlicensed users whenever the spectrum is vacant.

Fig. 6 shows the attack in more detail. Fig. 6 shows that SU perform sensing to detect the presence of PU. Based on sensing result SU confirms that PU is in inactive state. Therefore SU enters into transmission state. After completion of transmission SU again senses the network to check reappearance of PU i.e. PU is active because of emulation of malicious of SU. The result is spectrum mobility i.e. the SU has to vacate the spectrum resource currently underutilization.

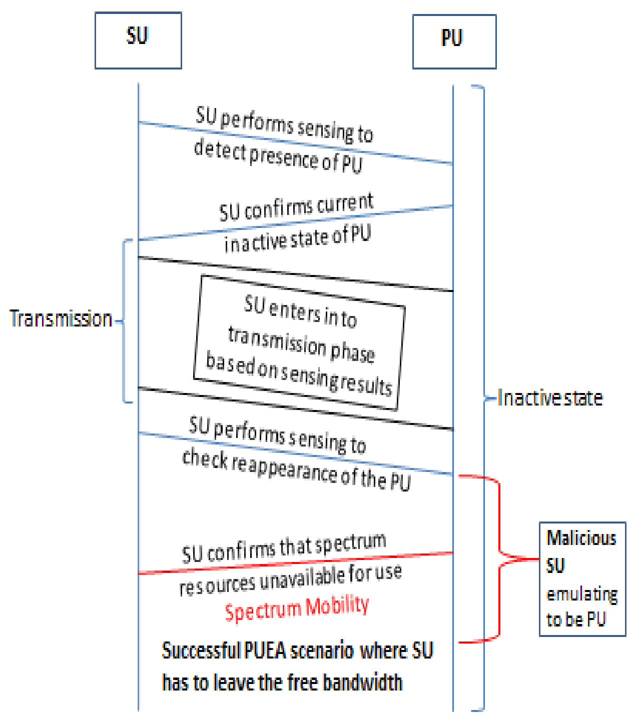


Figure 6: Flow Diagram depicting scenario of successful Primary User Emulation Attack[5].

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 6 Issue I, January 2018- Available at www.ijraset.com

IV. PROPOSED WORK

To overcome the PUE attack, a transmitter verification scheme based on position verification is proposed. Several localization schemes have been proposed one of them is TDOA. TDOA is suitable in CRN because it utilize the difference between the arrival times of pulse.

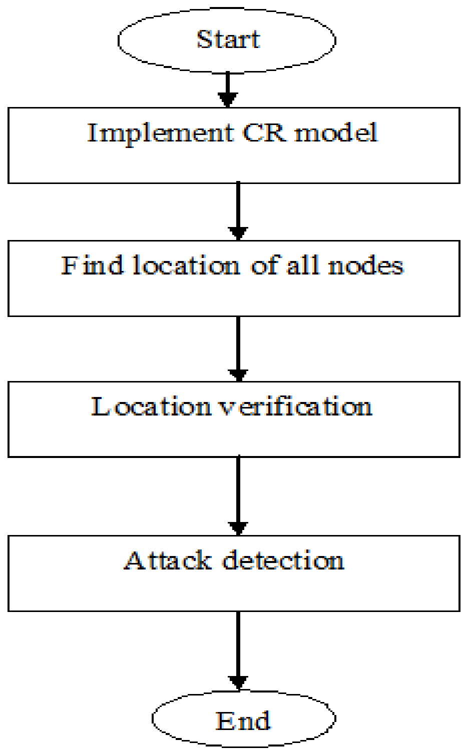


Fig 7 Block Diagram of Proposed System

A. *Localization of TDOA*

TDOA (Time Difference of Arrival) is simple method for positioning. It is a kind of non-interactive positioning and uses the difference of arrival time, which is fit for the location verification of fixed transmitters.

Time Difference of Arrival is technique for locating sources near a microphone array. By exploiting thedifferences in the arrival time of the sound to the microphones, TDOA locates the source of the sound.

Let $(x_m\ y_m, z_m)$ be the coordinates of M microphone. Let (x,y,z) be unknown coordinates of sources. Let T_m be the time of transit from sources to microphone m. Let v be the speed of sound. Let $D_m=vT_m$be the distance between the source and the microphone m. Let $\tau_m = T_m$- t1 be the difference in transit time between microphone m and microphone 1.

Note that $\tau_m=T_m - T_1$

Implies $\upsilon\tau_m=\upsilon T_m - \upsilon T_1=D_m - D_1$

And therefore $D_m^2=(\upsilon\tau_m+D_1)^2=\upsilon^2\tau_m^2+2\upsilon\tau_m+D_1^2$

We move everything over to get

$0=\upsilon\tau_m+2D_1+(D_1^2-D_m^2)/\upsilon\tau_m$ (1)

for m = 2,3,…,M. We now subtract $0=\upsilon\tau_m+2R_1+(D_1^2-D_2^2)/\upsilon\tau_m$from the above equation for m = 3,4,…,M. We then get the set of equations

$$0= \upsilon\tau_m - \upsilon\tau_2 + (D_1^2-D_m^2)/\upsilon\tau_m - (D_1^2-D_2^2)/\upsilon\tau_2$$

for m = 3,4,..,M. We then substitute

$$D_m=[(x_m-x)^2+(y_m-y)^2+(z_m-z)^2]^{1/2}$$

into the above equations to get

$$D_m^2= x_m^2-2x_m x + x^2 + y_m^2 - 2y_m y + y^2 + z_m^2 - 2z_m z + z^2$$

for m = 3, 4,…,M. Therefore

$$D_1^2 - D_m^2 = x_1^2 + y_1^2 + z_1^2 - x_m^2 - y_m^2 - z_m^2 - 2x_1x - 2y_1y - 2z_1z + 2x_mx + 2y_my + 2z_mz$$

for m = 2,3,…,M. We now solve substitute the above result into Equation (1) to get

$$0 = \upsilon\tau_m - \upsilon\tau_2 + \frac{1}{\upsilon\tau m}(x_1^2 + y_1^2 + z_1^2 - x_m^2 - y_m^2 - z_m^2 - 2x_1x - 2y_1y - 2z_1z + 2x_mx + 2y_my + 2z_mz)$$
$$- \frac{1}{\upsilon\tau m}(x_1^2 + y_1^2 + z_1^2 - x_2^2 - y_2^2 - z_2^2 - 2x_1x - 2y_1y - 2z_1z + 2x_2x + 2y_2y + 2z_2z)$$

for m = 3,4,…,M. We rewrite the above equation more succinctly as

$$0 = S_m + A_mx + B_my + C_mz$$

$$A_m = \frac{1}{\upsilon\tau m}(-2x_1 + 2x_m) - \frac{1}{\upsilon\tau 2}(2x_2 - 2x_1)$$

$$B_m = \frac{1}{\upsilon\tau m}(-2y_1 + 2y_m) - \frac{1}{\upsilon\tau 2}(2y_2 - 2y_1)$$

$$C_m = \frac{1}{\upsilon\tau m}(-2z_1 + 2z_m) - \frac{1}{\upsilon\tau 2}(2z_2 - 2z_1)$$

$$S_m = \upsilon\tau_m - \upsilon\tau_2 + \frac{1}{\upsilon\tau m}(x_1^2 + y_1^2 + z_1^2 + x_m^2 - y_m^2 - z_m^2) - \frac{1}{\upsilon\tau 2}(x_1^2 + y_1^2 + z_1^2 + x_2^2 - y_2^2 - z_2^2)$$

for m = 3,4,..,M. We rewrite the above set of M - 2 equations into matrix form to get

$$\begin{bmatrix} A3 & B3 & C3 \\ A4 & B4 & C4 \\ Am & Bm & Cm \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -S3 \\ -S4 \\ -Sm \end{bmatrix}$$

Moore-Penrose pseudoinverse of matrix can be applied to both sides to calculate x,y,z values.Note that the yields a solution only when M >= 5. In other words, you need 5 or more microphones.

V. PERFORMANCE PARAMETER

Following table shows the accuracy of location using TDOA method. Proposed model is simulated using 10 nodes which are defined in terms of (x,y,z). True values are randomly generated. Proposed scheme calculates estimated values using TDOA method. Accuracy of proposed system is calculated using true value and estimated value of node. This model is simulated with five different sets of location data and results are calculated and averaged which are given as follows,

Table 1: True and estimated position of 10 nodes

Set 1 TRUE VALUES ESTIMATED VALUES

	x	y	z		X	Y	Z
1	13.2676	3.9607	1.9426	1	13.2861	3.969	1.9392
2	-13.9885	-38.7237	6.342	2	-13.9852	-38.708	6.3349
3	46.4027	10.2028	8.7749	3	46.3928	10.1978	8.7849
4	1.8571	-18.9873	15.904	4	1.8601	-18.9847	15.9068
5	-9.3243	0.6005	8.9117	5	-9.3396	0.6035	8.9207
6	-8.1614	-31.2681	15.0937	6	-8.1655	-31.2839	15.0784
7	-5.8996	-12.4767	13.102	7	-5.9086	-12.4958	13.098
8	5.9619	5.5283	9.9673	8	5.9393	5.5038	9.9401
9	-25.8109	40.4545	11.7054	9	-25.8058	40.4448	11.702
10	0.0891	-11.1902	5.1019	10	0.0872	-11.1622	5.0811

Table2: Percentage accuracy of 10 nodes
(Difference between true and estimated)Conversion of -veval in +ve

								%acc x	%acc y	%acc z
1	-0.0185	-0.0083	0.0034	1	0.0185	0.0083	0.0034	98.15	99.17	99.66
2	-0.0033	-0.0155	0.0071	2	0.0033	0.0155	0.0071	99.67	98.45	99.29
3	0.0099	0.005	-0.01	3	0.0099	0.005	0.01	99.01	99.5	99
4	-0.003	-0.0026	-0.0028	4	0.003	0.0026	0.0028	99.7	99.74	99.72

5	0.0153	-0.003	-0.009	5	0.0153	0.003	0.009	98.47	99.7	99.1
6	0.0041	0.0158	0.0153	6	0.0041	0.0158	0.0153	99.59	98.42	98.47
7	0.009	0.0191	0.004	7	0.009	0.0191	0.004	99.1	98.09	99.6
8	0.0226	0.0245	0.0272	8	0.0226	0.0245	0.0272	97.74	97.55	97.28
9	-0.0051	0.0097	0.0034	9	0.0051	0.0097	0.0034	99.49	99.03	99.66
10	0.0019	-0.028	0.0208	10	0.0019	0.028	0.0208	99.81	97.2	97.92

Table3: True and estimated position of 10 nodes

Set 2 TRUE VALUES ESTIMATED VALUES

	x	y	z		X	Y	Z
1	-10.4667	4.4749	6.222	1	-10.4258	4.4546	6.2304
2	-41.8005	19.6033	3.6963	2	-41.8193	19.6131	3.6963
3	44.8783	-5.4715	8.7774	3	44.8937	-5.7439	8.7787
4	-0.2814	5.5488	8.7774	4	-0.2794	5.4784	8.1292
5	-2.28	29.6573	12.0569	5	-2.2814	29.6534	12.0603
6	6.2797	35.0019	2.3484	6	6.2807	35.0145	2.3207
7	-6.2127	13.4701	8.4833	7	-6.2104	13.4735	8.4823
8	21.8147	12.9968	5.2496	8	21.815	12.9957	5.2439
9	39.3776	7.3119	18.5771	9	39.3822	7.3134	18.5805
10	-36.4231	2.6113	11.5705	10	-36.4241	2.6122	11.5894

Table4: Percentage accuracy of 10 nodes

(Difference between true and estimated)Conversion of -veval in +ve

								%acc x	%acc y	%acc z
1	-0.0409	0.0203	-0.0084	1	0.0409	0.0203	0.0084	95.91	97.97	99.16
2	0.0188	-0.0098	0	2	0.0188	0.0098	0	98.12	99.02	100
3	-0.0154	0.2724	-0.0013	3	0.0154	0.2724	0.0013	98.46	72.76	99.87
4	-0.002	0.0704	0.6482	4	0.002	0.0704	0.6482	99.8	92.96	35.18
5	0.0014	0.0039	-0.0034	5	0.0014	0.0039	0.0034	99.86	99.61	99.66
6	-0.001	-0.0126	0.0277	6	0.001	0.0126	0.0277	99.9	98.74	97.23
7	-0.0023	-0.0034	0.001	7	0.0023	0.0034	0.001	99.77	99.66	99.9
8	-0.0003	0.0011	0.0057	8	0.0003	0.0011	0.0057	99.97	99.89	99.43
9	-0.0046	-0.0015	-0.0034	9	0.0046	0.0015	0.0034	99.54	99.85	99.66
10	0.001	-0.0009	-0.0189	10	0.001	0.0009	0.0189	99.9	99.91	98.11

Table5: True and estimated position of 10 nodes

Set 3 TRUE VALUES ESTIMATED VALUES

	x	y	z		X	Y	Z
1	-21.2762	2.4136	2.4122	1	-21.277	2.4135	2.4462
2	4.3936	29.1461	7.6924	2	4.3904	29.1384	7.7
3	-0.3308	29.1474	5.8088	3	-0.3322	29.1583	5.7956
4	-2.9579	30.7124	16.4875	4	-2.9563	30.7247	16.4901
5	-6.0818	-48.7553	6.8775	5	-6.0784	-48.7282	6.8789
6	22.7604	18.2978	18.1262	6	22.7649	18.2971	18.1308
7	18.1651	-40.0563	5.2146	7	18.1658	-40.0625	5.1988
8	29.421	4.1896	8.5052	8	29.4199	4.1902	8.4996
9	8.2546	13.2794	3.5753	9	8.257	13.2812	3.5797
10	17.5454	11.8	11.9705	10	17.574	11.8209	11.9962

Table6: Percentage accuracy of 10 nodes

(Difference between true and estimated)Conversion of -veval in +ve

								%acc x	%acc y	%acc z
1	0.0008	0.0001	-0.034	1	0.0008	0.0001	0.034	99.92	99.99	96.6
2	0.0032	0.0077	-0.0076	2	0.0032	0.0077	0.0076	99.68	99.23	99.24
3	0.0014	-0.0109	0.0132	3	0.0014	0.0109	0.0132	99.86	98.91	98.68
4	-0.0016	-0.0123	-0.0026	4	0.0016	0.0123	0.0026	99.84	98.77	99.74
5	-0.0034	-0.0271	-0.0014	5	0.0034	0.0271	0.0014	99.66	97.29	99.86
6	-0.0045	0.0007	-0.0046	6	0.0045	0.0007	0.0046	99.55	99.93	99.54
7	-0.0007	0.0062	0.0158	7	0.0007	0.0062	0.0158	99.93	99.38	98.42
8	0.0011	-0.0006	0.0056	8	0.0011	0.0006	0.0056	99.89	99.94	99.44
9	-0.0024	-0.0018	-0.0044	9	0.0024	0.0018	0.0044	99.76	99.82	99.56
10	-0.0286	-0.0209	-0.0257	10	0.0286	0.0209	0.0257	97.14	97.91	97.43

Table7:True and estimated position of 10 nodes

Set 4	TRUE VALUES				ESTIMATED VALUES		
	x	y	z		X	Y	Z
1	-10.7763	-33.0868	12.7706	1	-10.7909	-33.1218	12.7517
2	1.5256	0.704	6.392	2	1.3851	0.6402	6.2623
3	-14.9959	-21.9013	8.1524	3	-14.9943	-21.9001	8.1559
4	-8.0973	-40.1915	19.373	4	-8.1026	-40.2121	19.3571
5	-12.0827	23.66	2.1126	5	-12.0808	23.6594	2.0848
6	5.4981	-30.0491	8.4691	6	5.4961	-30.0443	8.4493
7	-0.4691	4.5169	3.0731	7	-0.4703	4.5247	3.09
8	-13.0664	5.1653	10.5429	8	-13.1057	5.1812	10.5743
9	16.2101	-16.1346	10.361	9	16.2118	-16.1338	10.372
10	-30.5945	-35.917	19.1539	10	-30.5936	-35.917	19.1375

Table8: Percentage accuracy of 10 nodes

(Difference between true and estimated)Conversion of -veval in +ve

								%acc x	%acc y	%acc z
1	0.0146	0.035	0.0189	1	0.0146	0.035	0.0189	98.54	96.5	98.11
2	0.1405	0.0638	0.1297	2	0.1405	0.0638	0.1297	85.95	93.62	87.03
3	-0.0016	-0.0012	-0.0035	3	0.0016	0.0012	0.0035	99.84	99.88	99.65
4	0.0053	0.0206	0.0159	4	0.0053	0.0206	0.0159	99.47	97.94	98.41
5	-0.0019	0.0006	0.0278	5	0.0019	0.0006	0.0278	99.81	99.94	97.22
6	0.002	-0.0048	0.0198	6	0.002	0.0048	0.0198	99.8	99.52	98.02
7	0.0012	-0.0078	-0.0169	7	0.0012	0.0078	0.0169	99.88	99.22	98.31
8	0.0393	-0.0159	-0.0314	8	0.0393	0.0159	0.0314	96.07	98.41	96.86
9	-0.0017	-0.0008	-0.011	9	0.0017	0.0008	0.011	99.83	99.92	98.9
10	-0.0009	0	0.0164	10	0.0009	0	0.0164	99.91	100	98.36

Table9: True and estimated position of 10 nodes

Set 5 TRUE VALUESESTIMATED VALUES

	x	y	z		X	Y	Z
1	-1.4083	-1.6015	5.6373	1	-1.3249	-1.5137	5.6038
2	-9.0962	-25.3471	9.9823	2	-9.0927	-25.3385	9.9899
3	-25.2167	9.0458	2.4786	3	-25.2045	9.0429	2.4525
4	14.7823	-19.5604	17.4785	4	14.7795	-19.5548	17.4893
5	3.4874	13.057	11.2996	5	3.4792	13.024	11.2862
6	-27.7627	15.9446	4.1195	6	-27.7391	15.9305	4.1205
7	41.2333	23.3721	2.1142	7	41.2264	23.3697	2.1159
8	3.559	6.146	12.4192	8	3.5353	6.1033	12.3688
9	27.1635	9.2197	18.624	9	27.1557	9.2182	18.6111
10	-2.7805	-36.3268	1.2681	10	-2.7782	-36.3388	1.2812

Table 10: Percentage accuracy of 10 nodes

(Difference between true and estimated)Conversion of -veval in +ve

								%acc x	%acc y	%acc z
1	-0.0834	-0.0878	0.0335	1	0.0834	0.0878	0.0335	91.66	91.22	96.65
2	-0.0035	-0.0086	-0.0076	2	0.0035	0.0086	0.0076	99.65	99.14	99.24
3	-0.0122	0.0029	0.0261	3	0.0122	0.0029	0.0261	98.78	99.71	97.39
4	0.0028	-0.0056	-0.0108	4	0.0028	0.0056	0.0108	99.72	99.44	98.92
5	0.0082	0.033	0.0134	5	0.0082	0.033	0.0134	99.18	96.7	98.66
6	-0.0236	0.0141	-0.001	6	0.0236	0.0141	0.001	97.64	98.59	99.9
7	0.0069	0.0024	-0.0017	7	0.0069	0.0024	0.0017	99.31	99.76	99.83
8	0.0237	0.0427	0.0504	8	0.0237	0.0427	0.0504	97.63	95.73	94.96
9	0.0078	0.0015	0.0129	9	0.0078	0.0015	0.0129	99.22	99.85	98.71
10	-0.0023	0.012	-0.0131	10	0.0023	0.012	0.0131	99.77	98.8	98.69

Table11: Average value of x position of all nodes.

Set 1	Set 2	Set 3	Set 4	Set 5	
% Accuracy x	% Accuracy x	% Accuracy x	% Accuracy x	% Accuracy x	Average
1	98.15	95.91	99.92	98.54	91.66
2	99.67	98.12	99.68	85.95	99.65
3	99.01	98.46	99.86	99.84	98.78
4	99.7	99.8	99.84	99.47	99.72
5	98.47	99.86	99.66	99.81	99.18
6	99.59	99.9	99.55	99.8	97.64
7	99.1	99.77	99.93	99.88	99.31
8	97.74	99.97	99.89	96.07	97.63
9	99.49	99.5	99.76	99.83	99.22
10	99.81	99.9	97.14	99.91	99.77

Table12: Average value of y position of all nodes.

Set 1	Set 2	Set 3	Set 4	Set 5	
% Accuracy y	% Accuracy y	% Accuracy y	% Accuracy y	% Accuracy y	Average
1	99.17	97.97	99.99	96.5	91.22
2	98.45	99.02	99.23	93.62	99.14
3	99.5	72.76	98.91	99.88	99.71
4	99.74	92.96	98.77	97.94	99.44
5	99.7	99.61	97.29	99.94	96.7
6	98.42	98.74	99.93	99.52	98.59
7	98.09	99.66	99.38	99.22	99.76
8	97.55	99.89	99.94	98.41	95.73
9	99.03	99.85	99.82	99.92	99.85
10	97.2	99.91	97.91	100	98.8

Table13: Average value of z position of all nodes.

Set 1	Set 2	Set 3	Set 4	Set 5	
% Accuracy z	% Accuracy z	% Accuracy z	% Accuracy z	% Accuracy z	Average
1	99.66	99.16	96.6	98.11	96.65
2	99.29	100	99.24	87.03	99.24
3	99	99.87	98.68	99.65	97.39
4	99.72	35.18	99.74	98.41	98.92
5	99.1	99.66	99.86	97.22	98.66
6	98.47	97.23	99.54	98.02	99.9
7	99.6	99.9	98.42	98.31	99.83
8	97.28	99.43	99.44	96.86	94.96
9	99.66	99.66	99.56	98.9	98.71
10	97.92	98.11	97.43	98.36	98.69

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 6 Issue I, January 2018- Available at www.ijraset.com

VI. RESULT

Figure 8 shows that the representation of 2D GUI. First graph is true position graph and second graph is eastimated position graph. Using TDOA algorithm we have to match both values. In following figure true position and estimated position values are not matched. Hence it might be chances of attack.

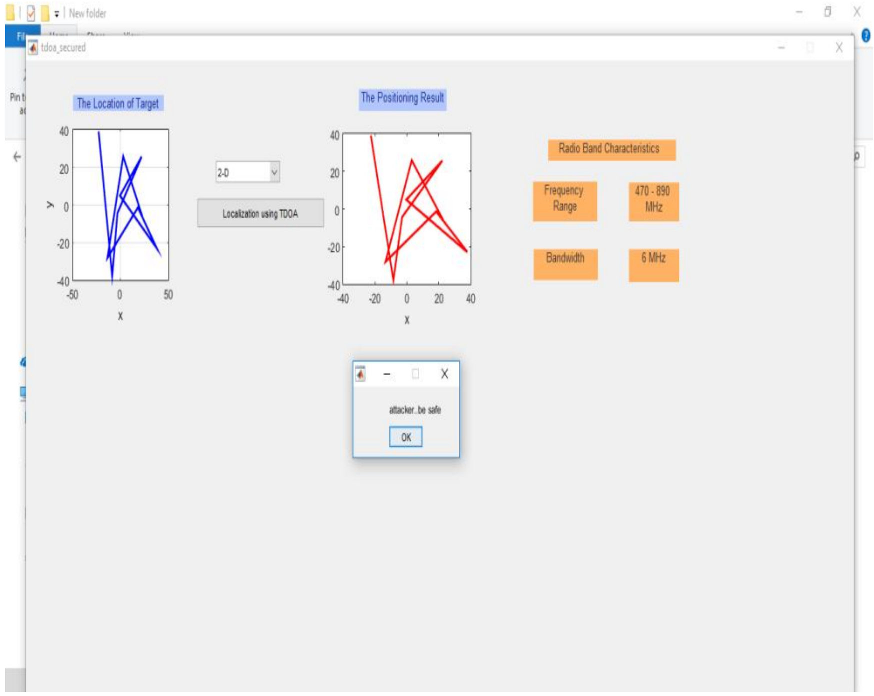


Fig. 8 Representation of 2D GUI

Fig. 9 shows the actual database values of the node. True position values and estimated position values are not matched. From these values we come to know that attack is happened in cognitive radio network. Furthere communication is not happen. Attacker uses the bandwidth for bad purpose. Hence all nodes are not valid.

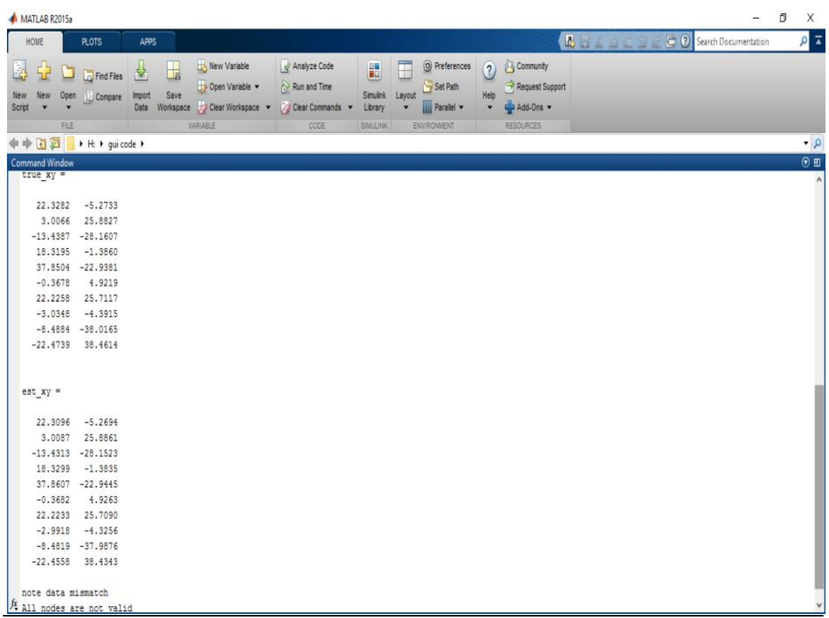


Fig. 9 Database values are not matched hence all nodes are not valid

Fig. 10 shows the database values are matched. True position and estimated position values are matched. Hence attack is not happen in cognitive radio netwwork. All nodes are valid hence further communication will take place properly.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 6 Issue I, January 2018- Available at www.ijraset.com

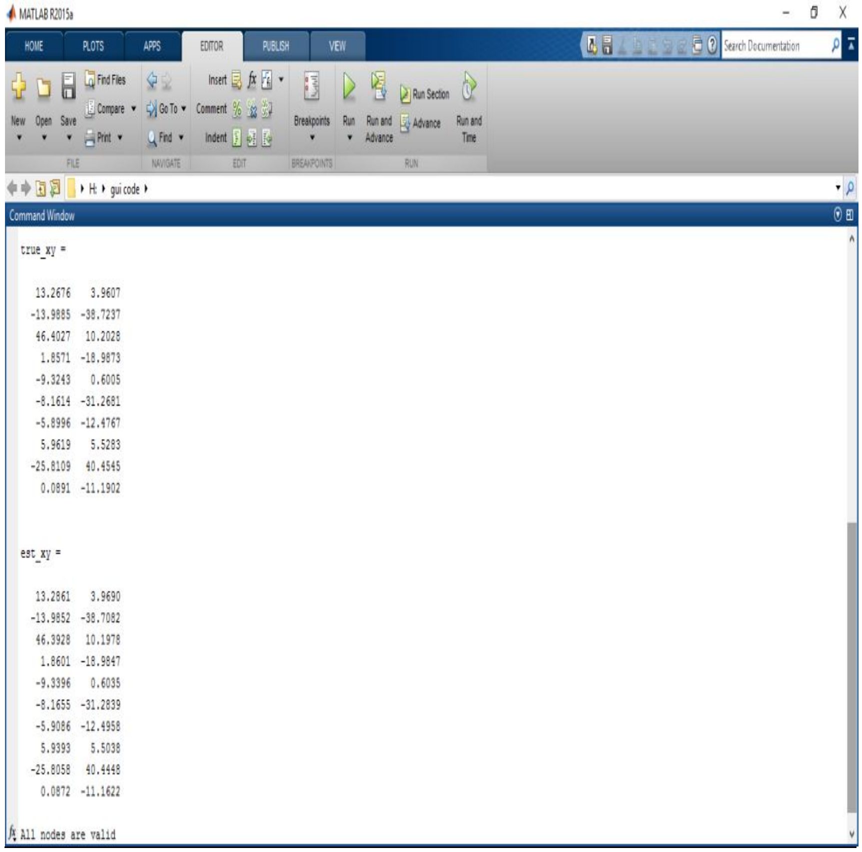


Fig. 10 Database values are matched hence all nodes are valid

Fig. 11 shows that the representation of 3D GUI. First graph is true position graph and second graph is eastimated position graph. Using TDOA algorithm we have to match both values. In following figure true position and estimated position values are not matched. Hence it might be chances of attack.

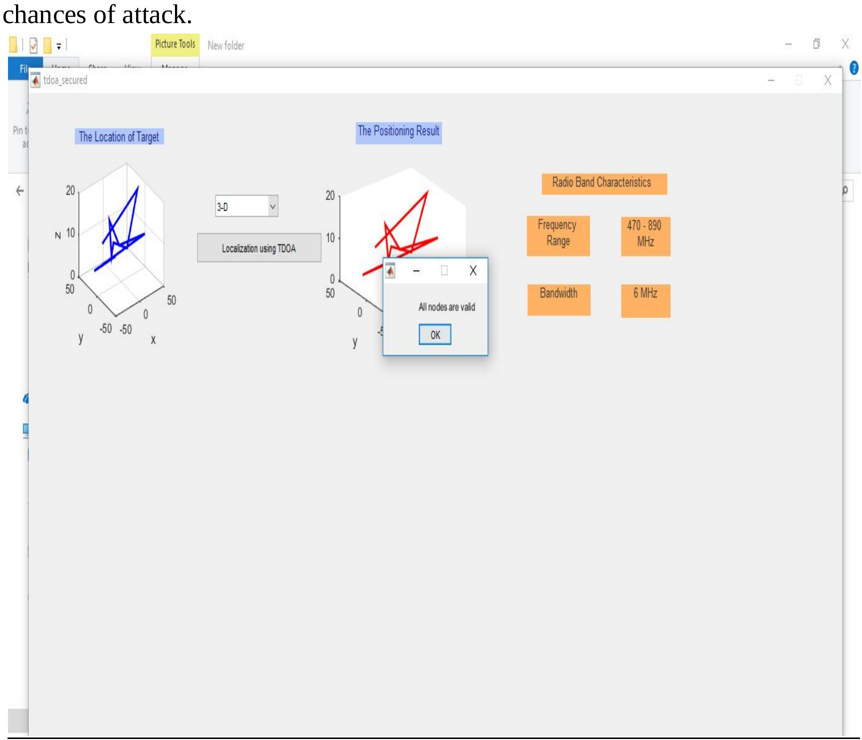


Fig. 11Representation of 3D GUI

Fig. 12 shows the actual database values of the node. True position values and estimated position values are not matched. From these values we come to know that attack is happened in cognitive radio network. Furthere communication is not happen. Attacker uses the bandwidth for bad purpose. Hence all nodes are not valid.

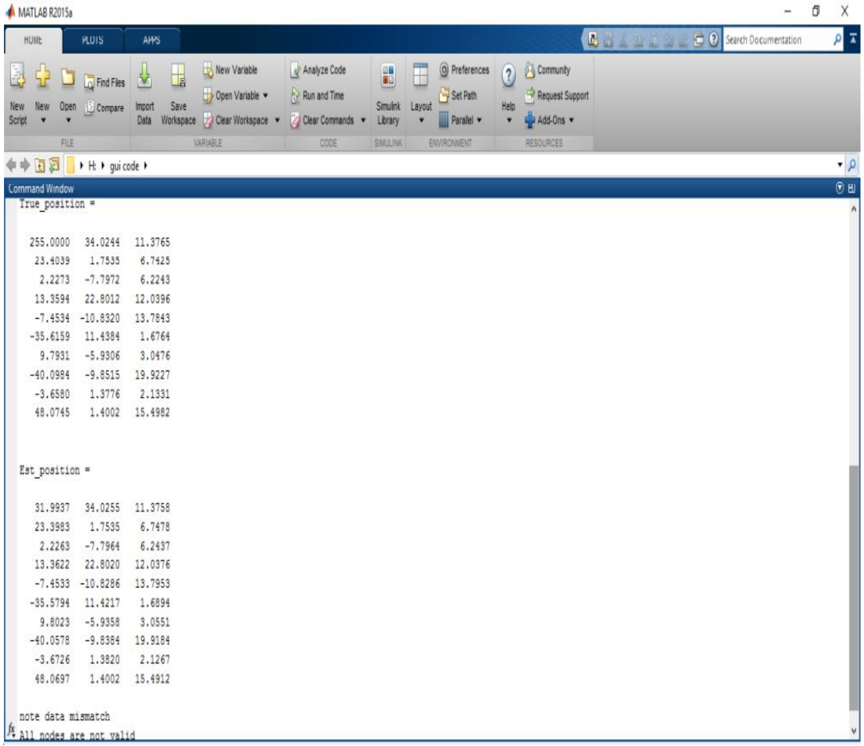


Fig. 12 Database values are not matched hence all nodes are not valid

Fig. 13 shows the database values are matched. True position and estimated position values are matched. Hence attack is not happen in cognitive radio netwwork. All nodes are valid hence further communication will take place properly.

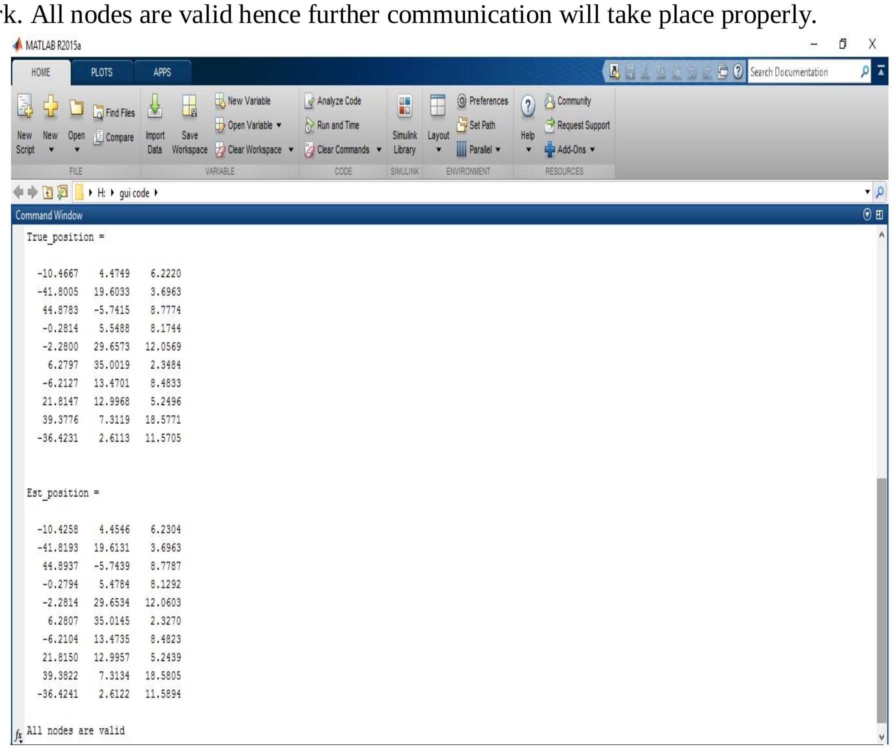


Fig. 13 Database values are matched hence all nodes are valid

VII. CONCLUSION

CRN is based on spectrum sensing mechanism. It defines spectrum holes in the spectrum which are unused by primary user. An attacker behaves as primary user and performs the PUE attack. The problem of PUEA can be solved using TDOA method. TDOA method finds the position of attacker. The proposed method has been implemented using MATLAB. A result shows that this method can improve the localization accuracy which strengths the ability of PUE attack.

REFERENCES

[1] W. R. Ghanem, M.Shokair and M. I. Desouky, "An improved primary user emulation attack detection in cognitive radio network based on Firefly Optimization Algorithm", 33rd National Radio Conference (NRSC 2016), Feb 22-25,2016 pp. 178-187.

[2] F. Jin, V.Vardharajan and U. Tupakula, "Improved detection of primary user emulation attack in cognitive radio network", International Telecommunication Network and Application Conference (ITNAC), Nov,2015, pp. 274-279.

[3] K. K. Chaunhan and A. K. Singh Sanger, "Survey of security threads and Attacks in cognitive radio networks", International Conference on Electronics and communication system (ICECS), Feb,2014, pp. 01-05.

[4] M. Dang, Z. Zhao and H. Zhang, "Optimal Cooperative Detection Primary User Emulation Attacks in Distributed Cognitive Radio Networks", 8th International Conference on Communication and Networking in China(CHINACOM), Aug,2013, pp. 368-373.

[5] Bilal Nqvi, Imran Rashid, Faisal Riaz, Baber Aslam, "Primary User Emulation Attack and their mitigation strategies: A survey", 2nd National Conference on Information Assurance(NCIA),2013

[6] C. Chen, H. Cheng and Y. Yao, "Cooperative Spectrum Sensing in Cognitive Radio Network in the presence of Primary User Emulation Attack", IEEE Transactions on Wireless Communication, Vol 10, no. 7, July,2011, pp. 2135-2141.

[7] D. Pu, Y. Shi, A. V. VIlyashenko and A. M. Wyglinski, "Detecting Primary User Emulation attacks in Cognitive Radio Networks", In Proceedings of the IEEE Global Telecommunication Conference(GLOBECOM)IEEE, Dec 2011, pp. 01-05.

[8] X. Ding, X. Gong and R. Wu, "The study onrelated algorithm of TDOA positioning," Modern ElectronicTechnology, No.1, 2009.

[9] R.Che, J. Park and J. Reed, "Defense against primary user emulation attacks in cognitive radio networks," IEEE Journal on Selected Areas in Communications, vol. 26, no.1, Jan. 2008, pp. 25-37.

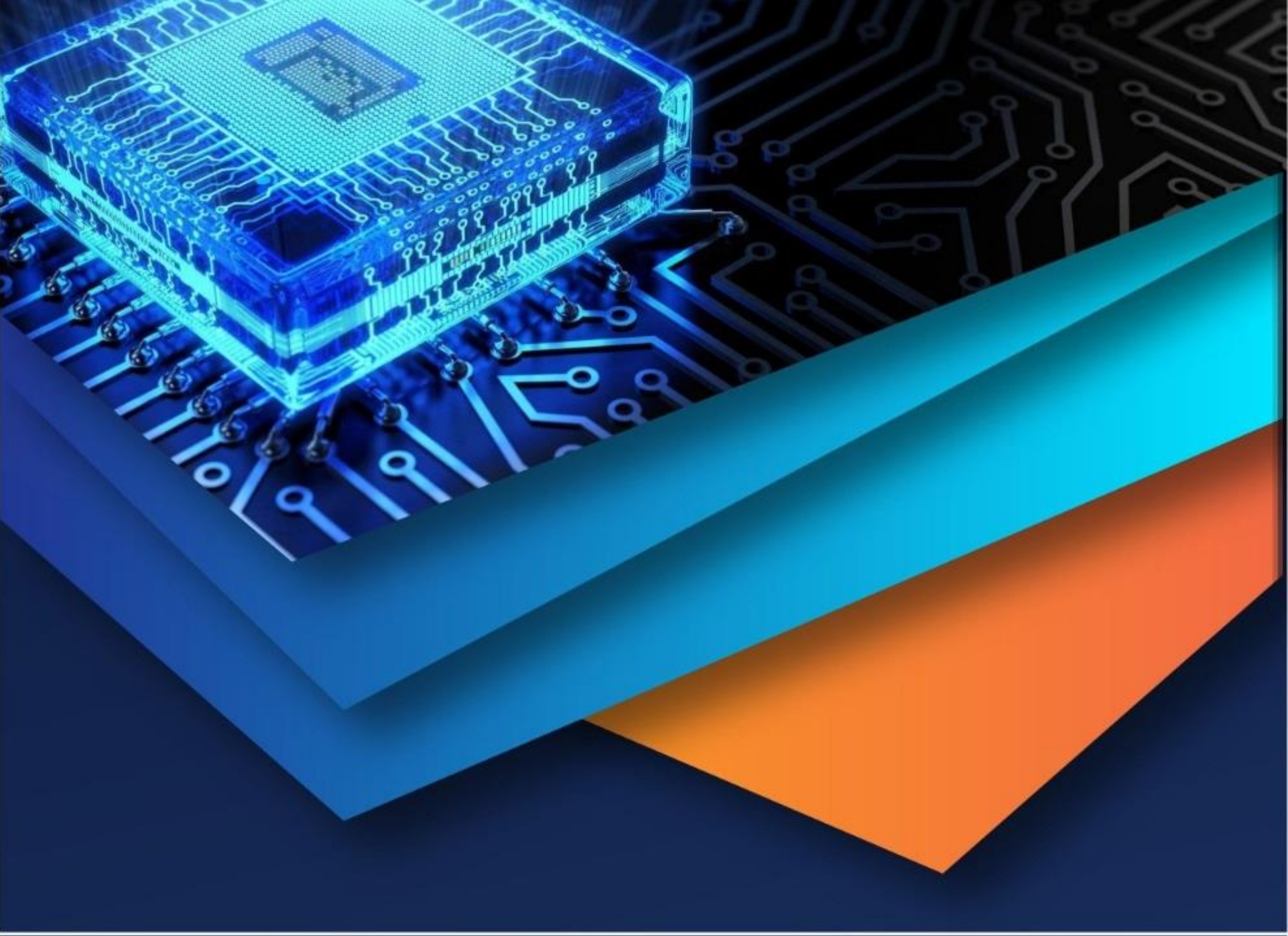
[10] S. Capkun, M. Cagalj and M. Srivastava, "Secure localization with hidden and mobile base stations," proc. IEEE Infocom, Apr. 2006.

[11] R Chen nd J Park, "Ensuring Trustworthy Spectrum Sensing in Cognitive Radio Network",1st IEEE workshop onNetworkingTechnologies for Software Defined Radio, SDR '06. 25-27sept. 2006 Pages(s):110-119.

[12] S. Haykin, "Cognitive radio: brain-empowered wirelesscommunications," IEEE Journal on Selected Areas inCommunications, Vol 23 (2), Feb. 2005, pp.201-220.

[13] Federal Communication Commission, "Notice for Proposed Rulemaking (NPRM 03-322): Facilitating Opportunities for Flexible Efficient and Reliable Spectrum Use EmployingCognitive Radio Technologies", ET Docket, No.03-108, Dec.2003.

[14] Theodore S. Rappaport, "Wireless Communication: Principles and Practice", Prentice Hall Communication Engineering and Emerging Technologies series, Pearson Publication India,2009, Second Edition.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY